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To solve $\frac{\partial^2 \varphi}{\partial t^2} = \sqrt{1+(\Delta h)^2} \frac{\partial^2 \varphi}{\partial x^2}$, put $m^2 =$

$\sqrt{1+(\Delta h)^2}$ and assume $\varphi = \tau(t) \cdot \xi(x)$; so that

$$\frac{\partial^2 \varphi}{\partial t^2} = \frac{d^2 \tau}{dt^2} \xi(x), \text{ and } \frac{\partial^2 \varphi}{\partial x^2} = \tau(t) \frac{d^2 \xi}{dx^2}. \quad \text{Sub-}$$

stituting these into the original equation, we find that the variables, t and x , can be separated by dividing through by $\tau \cdot \xi$ where-

$$\text{upon we have } \frac{d^2 \tau}{dt^2} \div \tau = m^2 \frac{d^2 \xi}{dx^2} \div \xi. \quad \text{Since the}$$

first of these two equal members cannot vary when t changes, nor the second when x changes, both must remain equal to some constant, say

$-m^2 n^2$. The two resulting equations yield the solutions

$$\xi = K_1 \cdot \sin[nx + \beta_1], \quad \tau = K_2 \cdot \sin[mnt + \beta_2]$$

whence $\varphi = K_1 K_2 \sin[nx + \beta_1] \sin[mnt + \beta_2]$

which we may then reduce to a more useful form:

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$$\begin{aligned} \int \frac{dx}{x} &= \frac{1}{x} \cdot \int dx - \int x \cdot [-1/x^2] \\ &= 1 + \int dx/x, \quad \text{whence } 0=1 !! \end{aligned}$$

$$\begin{aligned} \int \frac{dx}{5+7x^2} &= 1/5 \int \frac{dx}{1+\frac{7}{5}x^2} = \frac{1}{5} \sqrt{\frac{5}{7}} \int \frac{\sqrt{\frac{7}{5}} dx}{1+[\frac{7}{5}x]^2} \\ &= \frac{1}{35} \arctan [\sqrt{7/5} x]. \end{aligned}$$

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